Fall 2010

2010 (Fall)

University of Dayton. Department of Mathematics

Abstracts of the Colloquium Talks: Fall 2010
Department of Mathematics

Date	Speaker and Title	Time/Location
Tuesday, Aug 31	Murat Adivar, Izmir University of Economics Exponential stability and instability in delay dynamic equations using Lyapunov functionals	3:00 PM, SC 323
Thursday, Sep 9	Art Busch, University of Dayton Ramsey-type Numbers for Degree Sequences of Graphs	3:00 PM, SC 323
Thursday, Sep 16	Brenda Marshall, Wolfram Research Incorporated Experiencing Mathematica in Education: From Concept to Classrooms to Clusters	3:00 PM, SC 323
Thursday, Sep 23	Muhammad Islam, University of Dayton Almost linear Volterra integral equations and the existence of bounded solutions	3:00 PM, SC 323
Thursday, Sep 30	Billur Kaymakcalan, Georgia Southern University Some Dynamic Inequalities and Generalizations	3:00 PM, SC 323
Thursday, Oct 14	Anne Porter, University of Wollongong The Grand Scheme for Supporting the Learning in Mathematics Rich Disciplines	3:00 PM, SC 323
Thursday, Oct 21	Kimberly Kendricks, Central State University Detecting Terror: Predicting Wrist Placement in the Gait Cycle (An Application of Gröbner Basis Theory)	3:00 PM, SC 323
Thursday, Nov 11	James Booth, University of Dayton Two Examples in Applied Mathematics from a 27 Year Career in Engineering and Mathematics	3:00 PM, SC 323
Thursday, Nov 18	Aihua Wood, Air Force Institute of Technology Topics in Electromagnetic Scattering Analysis	3:00 PM, SC 323
Thursday, Dec 2	Daniel Slilaty, Wright State University Gain Graphs	3:00 PM, SC 323
Thursday, Dec 2	Daniel Slilaty, Wright State University Gain Graphs	3:00 PM, SC 323
Wednesday, Dec 15	Todd Schneck, University of Dayton Natural Gas Transportation: The Real Option Approach	**3:00 PM, SC 062**

EXPONENTIAL STABILITY AND INSTABILITY IN DELAY DYNAMIC EQUATIONS USING LYAPUNOV FUNCTIONALS

MURAT ADIVAR

Abstract. In this paper, we make use of the shift operators that were introduced by the authors in a previous paper, so that general delay dynamic equation of the form

$$x^{\Delta}(t) = a(t)x(t) + b(t)x\big(\delta - (h,t)\big)\delta_{-}^{\Delta}(h,t), \qquad t \in [t_0,\infty)_{\mathbb{T}}$$

can be analyzed with respect to stability and existence of solutions. By means of the shift operators we define a general delay function opening an avenue for the construction of Lyapunov functional on time scales. Thus, we use Lyapunov's direct method to obtain inequalities that lead to stability and instability. Therefore, we extend and unify stability analysis of delay differential, delay difference, delay h −difference, and delay q −difference equations which are the most important particular cases of our delay dynamic equation.

Ramsey-type Numbers for Degree Sequences of Graphs
Art Busch
Abstract: The party problem is a simple problem with a surprisingly complex answer: How many people must attend a party to guarantee that there is a group of k people at the party none of whom have previously met, or a group of k people all of whom have met each other previously. We will examine the solutions for $k = 3$ and $k = 4$ and some generalizations of the problem, including a new problem that relates the party problem to the degree sequence of a graph.

Experiencing Mathematica in Education From Concept to Classrooms to Clusters
Brenda Marshall
Abstract This talk focuses on the newest version of Mathematica which provides many new opportunities to integrate Mathematica in the classroom that it didn't provide in the past. You no longer need to teach Mathematica and your course – you can now simply teach your course and use

Mathematica integrated within that course without needing to spend time teaching Mathematica as well. Part of the talk will illustrate that concept for you.
You will be able to see how you can use only one tool to do complex computations, generate tests, write journal articles, create presentations for conferences and/or lectures and do everything you need for your research and teaching.

In addition, since Mathematica is probably looked at on campus as primarily useful for only math and/or physics, this technical talk will illustrate why the latest version of Mathematica specifically changes the pedagogy of teaching within chemistry, economics, psychology, sociology, engineering and of course math and physics along with other departments as well.

Almost linear Volterra integral equations and the existence of bounded solutions
Muhammad N. Islam
Abstract: A set of conditions are applied on the functions involved in certain Volterra type equations. The equations will be called almost linear when these conditions hold. Then the existence of bounded continuous solutions of these equations is studied. Krasnoselskii's fixed point theorem is used in the analysis as the primary mathematical tool.

Some Dynamic Inequalities and Generalizations
Billur Kaymakcalan
Abstract: We expose a survey of Dynamic Inequalities and recent generalizations in terms of Diamond-Alpha derivatives. Recent results of Opial type inequalities involving diamond-alpha derivatives and integrals are also given along with some applications.

The Grand Scheme for Supporting the Learning in Mathematics Rich Disciplines
Anne Porter

Abstract This talk focuses on three aspects of an Australian Learning and Teaching Council funded project *Building Leadership Capacity in the Development and Sharing of Mathematics Learning Resources, Across Disciplines, Across Universities.* The primary aim of this project is to develop leadership capacity, which in the simplest sense is to engage others in the sharing of predominantly video-based resources. The resources were to cover 100 level tertiary mathematics, statistics and bridging programs and thereby higher levels of university subjects in the disciplines that used 100 level mathematics and statistics. The sharing of technical expertise in relation to the use of the tablet PC has been one of the successes of this project. Hence the first focus of this talk, a demonstration of the use of the tablet PC in the production of resources. The creation of resources has led to questions as to the best ways to combine resources and hence my second focus on learning design for the effective delivery of mathematics based subjects. With several trials of new learning designs, incorporating different assessment strategies the third focus is on developing strategies to get students to communicate what they know.

Short Biography Associate Professor Anne Porter has been involved in Mathematics and Statistics Education since the 1970's. Trained as a secondary high-school mathematics teacher Anne worked for many years in the Department of Psychology and in later years in Learning Development at the University of Wollongong. For the last 14 years she has been a lecturer in statistics at the University of Wollongong, where she has concentrated on working with staff to improve students' learning outcomes. In 2007 Anne was awarded a 2007 Carrick citation for Outstanding Contribution to Student Learning for *Leadership in improving learning outcomes in informatics through staff mentoring in systematic quality improvement in processes and projects.* In 2008 she was awarded and Australian Teaching and Learning Council Grant for the project *Building leadership capacity in the development and sharing of Mathematics Learning Resources across disciplines, across universities.*

Detecting Terror: Predicting Wrist Placement in the Gait Cycle (An Application of Gröbner Basis Theory)

Kimberly Kendricks

Abstract: In 2009, the author worked with the Center for MASINT Studies and Research at the Air Force Institute of Technology and the Air Force Research Laboratory (AFRL) at Wright Patterson Air Force Base on the INSPIRE (Integration of a Sensor Package for Identifying Radical Extremists) project which seeks to analyze and identify threatening individuals through gait analysis. In this presentation, the author will discuss the development and use of an inverse kinematic model using Gröbner Basis Theory to isolate and determine the placement of certain segments of the body during the gait cycle. In particular, the presenter will discuss the results of using the kinematic model to predict wrist placement at any point in the human gait cycle.

Two Examples in Applied Mathematics from a 27 Year Career in Engineering and Mathematics

James Booth

Abstract: Prior to beginning his M.S. in Applied Mathematics, the presenter worked as a senior research engineer and a variety of first line management positions in technical areas. He is going to revisit two calculations performed in an analysis for nuclear reactor start up rods that were done in the 1970's and redo them today using MATLAB and Maple. The two calculations involve a heat transfer problem and the solution of six differential equations used to calculate the expected life of a nuclear reactor start up rod.

Topics in Electromagnetic Scattering Analysis

Aihua W. Wood

Abstract: In this talk we discuss the electromagnetic scattering phenomena in two settings: 1.) induced by cavities embedded in a perfectly electrically conducting (PEC) ground plane; 2.) by bodies of revolution (BOV). In the first case, we seek to determine the fields scattered by a protruding cavity upon a given incident wave. Our method decomposes the entire solution domain to two sub-domains via an artificial semicircle enclosing the cavity: the infinite upper half plane over the PEC ground plane exterior to the semicircle, and the cavity plus the interior region. The problem is solved exactly in the infinite exterior domain, and numerically in the interior domain. In the second case, we combine the efficiency of the locally corrected Nystrom (LCN) method with the simplicity of a BOV geometry. Specifically, we apply the LCN method to a BOR under plane wave illumination. The BOR geometry allows the 2D surface integral equation to be reduced to a series of 1D integral equations through the use of a Fourier series expansion. The solution of each 1D problem is a mode function in the series expansion of the total current.

About the speaker: Aihua Wood received her BS from Beijing University, China, and the MS and Ph.D. from the University of Connecticut, all in Mathematics. She was Visiting Assistant Professor at the Naval Postgraduate School, then Assistant Professor at Penn State University, Erie, before joining the Air Force Institute of Technology in 1994. She is now a Professor of Mathematics at AFIT.

Dr. Wood's research interests include elliptic partial differential equations, electromagnetic wave propagation, rarefied gas dynamics, and navigation technology.

Gain Graphs

Daniel Slilaty

Abstract: Given a graph and a group Γ, a Γ *gain function* is a labeling on the oriented edges of such that either when Γ is additive or when Γ is multiplicative. (Here is the edge in the opposite direction.)
A Γ *gain graph* is a graph along with a Γ *gain function*. In this talk I will go over the basics of gain graphs, some of their applications, and some open questions.

About the speaker:

Daniel Slilaty received his PhD from the State University of New York at Binghamton in 2000. His advisor was Tom Zaslavsky. During the 2000-2001 academic year he was a visiting assistant professor at the George Washington University in Washington DC. In the Fall of 2001 he came to Wright State University where he is currently an associate professor.

Natural Gas Transportation: The Real Option Approach

Todd Schneck

Abstract: In this paper the transportation of natural gas as a real spread option is evaluated. Real options are options on a physical asset that tend to behave like financial options and are a way of valuating real life events that mimic the properties of options. The transportation of natural gas behaves like a spread option; Kirk's approximation will be employed to evaluate the spread option.

Wednesday, December 15, 2010, in SC 062.